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GATE
Groupe d'Analyse et de Théorie Économique
UMR 5824 du CNRS

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GATE Groupe d'Analyse et de Théorie Économique
UMR 5824 du CNRS
93 chemin des Mouilles – 69130 Écully – France
B.P. 167 – 69131 Écully Cedex
Tél. +33 (0)4 72 86 60 60 – Fax +33 (0)4 72 86 60 90
Messagerie électronique gate@gate.cnrs.fr
Serveur Web : www.gate.cnrs.fr

Coalition formation: the role of procedure and policy flexibility

Annelies de Ridder[*], Agnieszka Rusinowska[†]
M. Elena Sáiz[‡], Eligius M.T. Hendrix[§]

Abstract

In this paper, we analyze a spatial model of coalition formation with data from Dutch elections and with theoretical results. First, we study different procedures of coalition formation. The model shows that procedure plays an important role in reaching a coalition agreement and that political parties do not necessarily benefit from being a first-mover. Moreover, it is shown that a decrease in a party's flexibility can be beneficial in coalition negotiations. Furthermore, we find that certain power sharing tactics do not always lead to an agreement that is in a party's advantage. The main message put forward is that the process of coalition formation plays a more important role than is usually acknowledged in literature and practice.

Keywords: coalition formation, elections, maneuvering space, step-by-step procedure, simultaneous procedure, minimal winning coalition

JEL Classification: D72, C7

[*]Radboud University Nijmegen, PO Box 9108, 6500 HK Nijmegen, The Netherlands, E-mail: anneliesderidder@gmail.com

[†]GATE, CNRS - Université Lumière Lyon 2 - ENS LSH, 93 Chemin des Mouilles, B.P.167, 69131 Ecully Cedex, France, E-mail: rusinowska@gate.cnrs.fr

[‡]Radboud University Nijmegen, PO Box 9108, 6500 HK Nijmegen, The Netherlands, E-mail: e.saiz@fm.ru.nl

[§]University of Wageningen, Hollandseweg 1, 6706 KN Wageningen, The Netherlands, E-mail: Eligius.Hendrix@wur.nl

1 Introduction

In multi-party democracies, political parties have to form coalitions to achieve majority governments. As a part of coalition negotiations, coalition members bargain and agree on a package of policy agreements, the coalition agreement (Timmermans, 2003, provides an extensive discussion on coalition agreements). In 63% of the coalition formations in Western-Europe studied by Müller and Strøm (2003), such coalition agreements were reached (in e.g. Austria, Ireland, Belgium, and The Netherlands). In order to reach such a coalition agreement, parties in the coalition will have to make compromises as each party has its own ideal policy. Only by adjusting their policy positions, parties can reach the compromise needed for the coalition agreement. This flexibility of political parties in the negotiations on coalition agreements is one of the central subjects of this paper.

The second central subject is the procedure used to reach a coalition. Roughly speaking, two different ways of coalition formation can be discerned: a step-by-step or hierarchical procedure versus a simultaneous or non-hierarchical procedure (Laver & Schofield, 1990). The step-by-step approach sees coalition formation as a process in which the group incrementally forms: new members are added gradually. An alternative approach is to negotiate immediately with *all* the members of the coalition, as in a simultaneous procedure. In spite of these two different procedures which are recognized in the literature and which both occur in real life coalition formation, little attention has been paid to the consequences of these procedures for the result of coalition formation. However, some earlier theoretical results show that procedure plays an important role in coalition formation and that, except for some special situation, different procedures lead to different results (De Ridder & Rusinowska, 2008). The special conditions require that the ideal positions of the players are really close, which is unrealistic in a political setting.

In this paper, we study the two dynamical aspects of coalition formation just discussed (procedure and policy flexibility). We study those two aspects by analyzing a formal model and deducing implications from this model based on real-life data. The model was introduced earlier in De Rid-

der and Rusinowska (2008), where a formal presentation of the model and the different procedures are found. The model is positioned among spatial coalition models (based on Downs, 1957, see e.g. Grofman, 1982; Laver & Shepsle, 1996). In De Ridder and Rusinowska (2008), the model has been applied to alliance formation between firms. In Sáiz, Hendrix, De Ridder and Rusinowska (2007), the computational aspects of both the model and the empirical test are discussed. Here, we focus on the model implications concerning coalition formation dynamics by using the model to arrive at examples based on data from Dutch elections. Based on our findings, we discuss the implications for political science.

This article aims at a contribution in the field of political science, in particular, in formal and spatial coalition modeling. The field of research of formal coalition models is large and extensive, see, amongst others, Von Neumann and Morgenstern (1953), Axelrod (1970), Grofman (1982), Van Deemen (1989), Laver and Shepsle (1996), Warwick (1998), De Vries (1999) and Martin and Stevenson (2001). So far, most of those studies have focussed on why coalition form and, based on that, which parties will cooperate. Arguments for coalition formation were found in power, policy, or institutional arguments. However, the strategy and process of coalition formation have been ignored in the literature (Laver & Schofield, 1990): how will coalitions be formed, and, what is the best strategy for a party during the process of coalition formation? Also, from a more formal theoretical point of view, several authors have pointed at this lack of dynamics in the models (Van Deemen, 1997; Tohmé & Sandholm, 1999; Arnold & Schwalbe, 2002). It seems unnatural to analyze coalition formation with a static approach, since coalition formation is clearly dynamic in nature: for example, parties need a few weeks, sometimes months, to reach a coalition agreement, different procedures are used to form a coalition, and parties move their positions to be able to compromise. The suggestion that process plays a role in coalition formation - and should thus be included as an explanatory variable - is strengthened by earlier research (Austen-Smith & Banks, 1988; Baron, 1993; Bloch, 1996; Brams, Jones, & Kilgour, 2005; De Ridder & Rusinowska, 2008). This earlier research has not evolved towards a coherent and empirically verified stream of research, and, moreover, the role of procedure has

been ignored.

In this article, we aim to make two major points and one minor point concerning the strategies political parties should adopt during the process of coalition negotiations. The first major point is to stress the role of coalition formation procedure. Two different procedures of coalition formation, leading to different coalition positions, are under study. Earlier research on coalition formation has mainly neglected the role of procedure in coalition formation (e.g. Martin & Stevenson, 2001, exceptions are Bloch, 1996; Brams, Jones, & Kilgour, 2005). We validate earlier theoretical results (De Ridder & Rusinowska, 2008) of the important role for procedure and we focus on the first-mover advantage. The question is whether being a first-mover is always advantageous for a party in coalition negotiations, as in real-life the biggest party, after elections, is most often rewarded with the initiative for coalition negotiations.

As a second major point, we focus on policy flexibility of parties. One of the central assumptions of our model is that parties have maneuvering spaces which reflect their flexibility to deviate from their ideal positions. No party will accept a coalition position which lies outside its maneuvering space. This assumption is similar to the one made in a policy-horizon model by Warwick (2000, 2005a, 2005b). Warwick examines the hypothesis that coalition government formation in West European parliaments is constrained by the existence of limits or bounds (called policy horizons) on the extent to which parties can compromise on their policy positions in order to participate in government. While Warwick focuses on developing methods to estimate these policy horizons and on applying the methods to data on West European parliamentary systems, our aim is different. In this article we neither aim at estimating the maneuvering spaces nor at forecasting which coalition will form, rather we focus on the process to reach a coalition and the strategies the parties should adopt in this process. The question we pose is whether being flexible in coalition negotiations is advantageous for parties. Is a party better off by being more or less flexible?

Additionally, we want to study a minor point: the role of sharing power. The question here is whether striving for a coalition in which a party gets the best relative power position is always advantageous. Earlier empirical results

confirm the role of power-sharing motives of parties (Martin & Stevenson, 2001), but do not show that oversized can be an advantage for coalition members (cf. Volden & Carruba, 2004 who explain when oversized coalitions occur). Sub-issues here are the minimal winning argument (Von Neumann & Morgenstern, 1944) and the influence of weight. The minimal winning argument states that only coalitions will form that have enough members to be winning, but not more than that. But is a minimal winning coalition necessarily advantageous for a party? Or, more general, is a smaller coalition necessarily more advantageous than an oversized coalition? Concerning weight, we like to consider the consequence the weight of a party (number of seats in parliament) has for its coalitional partners. The last research question is then: Does an increase of a party's weight imply a disadvantage for its coalition partners?

Those questions are answered by deducing implications from the theoretical model presented. We have performed calculations with the model using data from Dutch politics, and, moreover, we present some theoretical results. Both the empirical and theoretical calculations provide some counter-intuitive situations which show that certain expectations do not always hold. Also, we illustrate that certain traditions in real-life coalition formation are not necessarily advantageous.

During the paper, we study which strategic moves are advantageous for a potential coalition member. *Advantageous* is defined in terms of preference of a party over a coalition and the path to reach this coalition. This is measured by taking the distance from the ideal position of the party to the position of the coalition compromise. The closer the coalition position, the better. The policy-distance effect on government composition, meaning that the incentive of a party to join a parliamentary coalition government decreases with the distance between the policy position and the position of the government, was elaborated and tested in particular by Warwick (1998).

This paper is organized as follows. Section 2 presents the theoretical background. We start with recapitulating the model of coalition formation (Section 2.1). Subsequently, the three issues and their theoretical expectations are discussed: the procedures of forming a coalition (Section 2.2), the flexibility of parties (Section 2.3), and the role of power sharing (Section 2.4).

In Section 3, we elaborate on Dutch data and the way we calculate in the model. Section 4 shows counter examples with empirical and theoretical data studying the hypotheses. Finally, Section 5 concludes with a discussion of the findings and implications for theory and practice.

2 Theoretical background

2.1 The model

We deal with the following model of spatial coalition formation, considered in De Ridder and Rusinowska (2008). There are n players, here political parties, which try to form a majority coalition S and to decide about a policy of the coalition x_S hereafter called the coalition position. This coalition position is the formal representation of the policy agreement of a coalition. Party $i \in N$, where N denotes the set of all parties, has a weight $w_i > 0$, which is based on the number of seats in parliament party i possesses.

Each party i may choose a policy position x_i from an m-multidimensional Euclidean policy space $\mathbb{R}^m$, $m \geq 1$. A distance between two positions $x_i = (x_{i1}, ..., x_{im})$ and $x_j = (x_{j1}, ..., x_{jm})$ is given by

$$d(x_i, x_j) = \sqrt{\sum_{k=1}^{m} (x_{ik} - x_{jk})^2}. \tag{1}$$

Parties have a certain amount of flexibility on the policy positions, i.e., they have their preferences defined in $\mathbb{R}^m$. Each player $i \in N$ is assumed to have an ideal position $x_i^* \in \mathbb{R}^m$, which is the most preferred position of party i, and a maneuvering space, an equivalent of the policy horizon by Warwick (2000), which consists of all positions acceptable to party i. We assume the maneuvering space to be a ball in $\mathbb{R}^m$. By M_i we denote the maneuvering space of party i with middle point x_i^* and radius r_i, i.e.,

$$M_i = \{y \in \mathbb{R}^m \mid d(x_i^*, y) \leq r_i\}. \tag{2}$$

The maneuvering space of a party is then the set of policy positions with distances from the ideal position of the party not greater than the radius.

Of course, some positions are more preferred to a party than others. Preferences of a party on positions are expressed by the following rule: the closer a position is to the ideal position of a party, the more preferred this position is to the party.

Given coalition $S \subseteq N$ and the ideal positions x_i^* for $i \in S$, all parties of the potential coalition S have to agree on a coalition position for S. In the next subsection, we recapitulate two alternative procedures for forming a coalition and choosing a coalition position for that coalition. Although the procedures differ from each other, there are two common assumptions for these procedures. First of all, it is assumed that no party will agree on a position which does not belong to its maneuvering space as these positions are unacceptable for a party. In other words, the necessary condition for a coalition S to be formed is a non-empty intersection of the maneuvering spaces of all members of S (we call this a feasible coalition), i.e.,

$$\bigcap_{i \in S} M_i \neq \emptyset,$$

and of course, the position x_S of the formed coalition S must belong to this intersection as there has to be commonality in positions, i.e.,

$$x_S \in \bigcap_{i \in S} M_i.$$

A similar assumption is adopted in the policy-horizon model: 'With horizons, there are definite limits to the willingness of parties to compromise on policy in order to participate in government; beyond those limits, parties would prefer to remain in opposition' (Warwick, 2000, p. 39). An illustration of the model in a three-party, two dimensional example is given in Figure 1.

2.2 Procedures

Now, our approach takes a different course from the one adopted by Warwick. To find a solution to our basic coalition formation model, we consider and compare two procedures: a step-by-step procedure and a simultaneous procedure. These two procedures coincide with the distinction in political science literature between hierarchal and non-hierarchal coalition formation

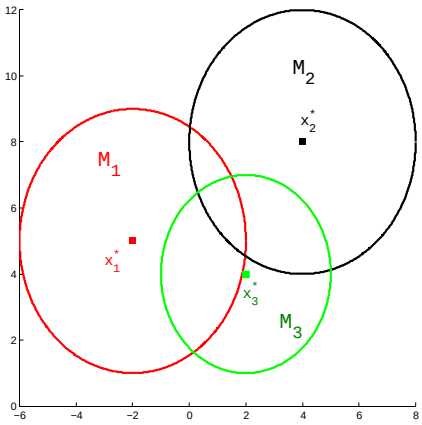

Figure 1: Illustration of the model.

(Laver & Schofield, 1990). So far, spatial coalition theories have most often neglected the different procedure of forming a coalition (as in Grofman, 1982 who studies one procedure, but see Bloch, 1996, and Brams et al., 2005, who do consider the consequences of different procedures). In De Ridder and Rusinowska (2008), it has formally been proven that it matters which procedure is adopted, and also that there is no procedure which is always better.

The first kind of procedure, the hierarchal view, sees ' ... coalition building as a process in which actors with similar policy preferences first get together in some sort of provisional alliance and, only after this has been done ..., do they cast around for other coalition partners, adding these until the formation criterion is satisfied' (Laver & Schofield, 1990, p. 140). The proto-coalition model of Grofman (1982) is such a hierarchial model. In the model we present here, the step-by-step procedure is a hierarchical procedure. Although it is difficult to look behind the often closed doors of coalition negotiations, e.g. Ireland, Belgium, and Denmark have known instances of this step-by-step approach (Müller & Strøm, 2003).

In the step-by-step procedure, the first step is that two parties (e.g. party 1 and 2) negotiate. These two will reach an agreement if their maneuvering spaces overlap and hence a first coalition position $x_{\{1,2\}}$ is agreed on. This coalition position is determined by choosing a position in the intersection of

their maneuvering spaces and taking the weights of the players into account. That is, a big party can pull the coalition position more towards its ideal. To be more precise, when determining $x_{\{1,2\}}$, first, parties 1 and 2 each choose a position (called the negotiation position) in the intersection of the maneuvering spaces such that the distance of that position to the ideal point of the party is minimal. These negotiation positions are denoted with $\widetilde{x}_1$ and $\widetilde{x}_2$. The coalition position $x_{\{1,2\}}$ is the gravity center (a weighted average) of the negotiation positions.

Now, a third party (3) joins the negotiations. Players 1 and 2 operate as proto-coalition {1,2}, and an agreement with 3 is only reached if the maneuvering spaces of 1, 2, and 3 overlap. If so, coalition $\{1, 2, 3\}$ with position $x_{\{\{1,2\},3\}}$ is formed, which is the gravity center of the negotiation positions of the proto-coalition $\{1, 2\}$ and party 3. This process continues with adding new parties until a majority coalition S with position $x_{\overline{S}}$ has been reached, where $\overline{S}$ denotes an order, a set of parties, that indicates the sequence that leads to coalition S. In De Ridder and Rusinowska (2008), it has been proven that this step-by-step procedure leads to a unique and Pareto efficient solution. Hence, one coalition position is reached such that there is no other position in the intersection of the maneuvering spaces that is more preferred by all members of the coalition. An illustration of the step-by-step procedure of forming a three-party coalition is given in Figure 2.

Second, we also find a non-hierarchial approach which considers coalition formation as a one-step procedure. Laver and Shepsle (1996) generalize political coalition formation as a process in which one party proposes a particular cabinet, which can be vetoed by all its members. In such a case, there are no proto-coalitions which form intermediate steps before a definitive coalition is reached. Non-hierarchical coalition formation is a process in which all the parties of a coalition sit round the table to negotiate simultaneously. In the overview of coalition formation in Western-Europe, Müller and Strøm (2003) report many instances of such a way of bargaining.

In our model, the simultaneous procedure looks as follows. If parties $1, 2,$ and 3 form coalition $\{1, 2, 3\}$, their coalition position is $x_{\{1,2,3\}}$. A coalition forms if maneuvering spaces of all three parties overlap. Again, the coalition

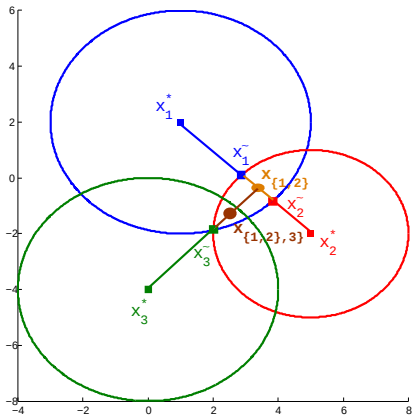

Figure 2: The step-by-step procedure

position will be in the intersection of their three maneuvering spaces and will depend on the weights of the players. The position $x_{\{1,2,3\}}$ is the gravity center of the negotiation positions of all parties in question. More general, the simultaneous procedure of forming a majority coalition S results in a position x_S of the coalition. Again, it has also been proven that this procedure leads to a unique and Pareto optimal solution (De Ridder & Rusinowska, 2008). An illustration of the simultaneous procedure of forming a three-party coalition is given in Figure 3.

Beware that although both the step-by-step procedure and the simultaneous procedure can study a coalition with for instance parties $1, 2$, and 3, their respective outcomes are usually different (an exception and special case is when the ideal positions of two parties starting the coalition formation process belong to the intersection of the maneuvering spaces of the three parties, the step-by-step procedure with the given parties' order of forming a coalition, and the simultaneous procedure lead to the same position for the coalition.). According to the step-by-step procedure, this coalition $\{1, 2, 3\}$ can form in three different ways: first a bilateral agreement with two parties and then the third party $1, 2$ or 3 respectively joins. The simultaneous procedure predicts just one way of forming the coalition: all negotiate together. Hence, in spite of a cooperation between the same three parties, four different paths to form a coalition and four different coalition positions are discerned:

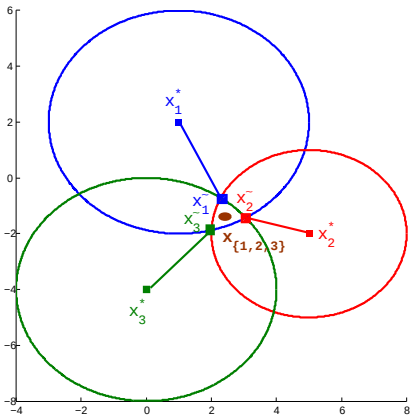

Figure 3: The simultaneous procedure

$x_{\{\{1,2\},3\}}$, $x_{\{\{1,3\},2\}}$, $x_{\{\{2,3\},1\}}$, and $x_{\{1,2,3\}}$.

Calculations have shown that the number of different paths and coalition positions can increase dramatically. In a coalition game with ten parties, $2^{10}-11 = 1013$ different 10-party coalitions are possible. However, when taking different procedures into account, 4932045 different step-by-step coalitions can be discerned plus 1013 simultaneously formed coalitions. In sum, if ten parties play a coalition game, there are 4933058 different ways of forming a coalition. This number is calculated from the following formula:

$$\binom{10}{2} + \frac{1}{2}\sum_{k=3}^{10}\binom{10}{k}k!.$$

.

Disregarding some special conditions, the two procedures usually lead to different positions for the coalition and consequently different appreciations by the coalition members. Given the distance between the ideal position of a party and the coalition position, parties will have a preference ranking over the different positions of the coalitions, over the different coalitions, and hence over the procedures to reach them. The closer a coalition agreement is to the ideal position of a party, the more this party will prefer this coalition agreement. In this way, we show that parties should not only form preferences over coalitions, but should also take the procedure into consideration. In

conclusion, the procedure of coalition formation should be a strategic resource in coalition formation and should play a role in coalition negotiations similar to the composition of the coalition.

However, empirical observations of how coalitions form show that procedures are usually not used as a strategic resource, but procedure is rather the result of unwritten laws and traditions (e.g. Belgium, Finland, Luxembourg, and The Netherlands, Müller & Strøm, 2003). An important observation is that in many multi-party democracies, it is a habit that the party that came out of the elections as the largest to get the initiative (from a head of state) for forming a coalition (Isaksson, 2005). Examples of countries in which this (more or less frequently) happens are The Netherlands, Sweden, Finland, Austria, Belgium, and Luxembourg (Müller & Strøm, 2003). The idea behind this is that these initiative taking parties are supposed to lead the negotiations and to have an advantage in the bargaining situation. Research of Ansolabehere, Snyder, Strauss, and Ting (2005) shows that the party forming the coalition government indeed receives a substantial bonus relative to its weight concerning the ministers posts its gets as compared to parties that join the coalition, but which did not form. Also concerning policy rewards, the earlier a party is involved in coalition negotiations, the more this party is able to pull the negotiations towards its own ideas. In this way, this party can determine and influence the negotiations more and can get advantage out of it. This brings us to the first hypothesis:

H1: Being a first-mover in coalition negotiations is advantageous.

2.3 Flexibility

The second important aspect of our model is the flexibility during negotiations we attribute parties via maneuvering spaces. To negotiate in the parliamentary arena, political parties use input from the electoral arena: both the amount of seats a party has gained after elections and the multi-dimensional policy positions they have taken during the elections. The assumption is that, in the parliamentary arena, these policy positions are also multi-dimensional. We will question another assumption often made in the literature of coalition

formation models, namely that political parties have a fixed position in policy space (Grofman, 1982; De Vries, 1999). Both during elections (Enelow & Hinich, 1984; Budge, 1994; Van der Brug, 1999; Laver, 2005) and coalition negotiations (Warwick, 2000), the policy position of a party is more subject to change than is usually assumed. Both in the parliamentary and electoral arena, '...positions are not frozen or fixed; parties move in the policy space in different directions over time' (Timmermans, 2003, p. 9). Here, we focus on dynamics of policy positions in the coalition formation phase.

The idea is that in order to form a coalition, political parties will move their policy position, but only *to a certain limit* (Warwick, 2000) as formalized in our model by the maneuvering space. Coalition formation implies making a coalition agreement: a compromise between the members of a coalition on the ideological course of the coalition, consisting of a position for the coalition. As a consequence, parties participating in a coalition need to adjust their position in order to reach such an agreement (Martin & Vanberg, 2004). It is not likely that parties will cooperate with a party which has opposing policy ideals. We therefore assume parties will only be willing to compromise if they can stay within their maneuvering space of acceptable positions.

The question now rises what is mostly in a party's interest: a big or small maneuvering space? When forming a two-party coalition, the answer is straightforward: being less flexible is never disadvantageous. If a coalition consists of only two parties, the more flexible party of the two will be forced to move its position more than the other. One can speak of a zero-sum situation: what one wins, is lost by the other.

Nonetheless, when forming a k-party coalition, for $k \geq 3$, the answer is less easy. Intuitively, one would consider that staying closer to a party's ideal position is also better in multi-party coalitions. Hence, a decrease in flexibility would always be in a party's advantage. However, this is less easy to analyze due to the amount of players involved. Therefore, we use the data and theoretical results to study whether the following (second) hypothesis holds:

H2: Being less flexible in coalition negotiations is more advantageous.

2.4 Sharing power

As a final point, we study the role of sharing power. Coalition formation has long been considered as a combination of achieving power, and simultaneously sharing this power with coalition partners. Coalition formation is therefore a delicate balance between on the one hand getting this power by compromising into the coalition, and on the other hand, forming a coalition which gives a party relatively the best power. In this tradition, the minimal winning (Von Neumann & Morgenstern, 1944) and minimum size theory (Riker, 1962) have been formulated.

In the introduction, it was already explained that minimal winning coalitions are coalitions that contain enough members to be winning, but are not oversized. Minimal winning coalitions cannot miss any member without becoming losing. Minimum size coalitions contain enough weight to be winning, but not more than that.

In line with this, one could reason that oversized coalitions imply sharing power with more partners and hence compromising with more partners than necessary. The chance is bigger that a coalition position will be reached which is farther from a party's ideal position. Less members in a coalition make it easier to reach an agreement which is closer to a party's ideal point. Hence hypothesis 3a:

> *H3a: Being in a smaller (winning) coalition is more advantageous than being in an oversized coalition.*

In a similar way, we can argue that forming a coalition with a stronger partner is not advantageous, since the stronger party may 'pull' the position of a formed coalition more towards it's own ideal position. Hence we propose hypothesis 3b:

> *H3b: Increase of a party's weight is disadvantageous for its coalition partners.*

3 Empirical illustration

From the model discussed in the theoretical background section, we have highlighted three aspects: the procedures, flexibility of parties, and power sharing. Different procedures can lead to different positions and hence are crucial for the result of coalition formation. Also, the degree of flexibility of a party is important for the results of coalition formation. Power sharing has always been considered an important element of coalition formation. To study these issues, we perform calculations with the model using data from Dutch elections, next to some theoretical results. The aim is not to provide an empirical test of the model, but to arrive at model implications, partly based on real-life counter-examples, which tell us whether the posed hypotheses always hold. In this section, we elaborate on the Dutch setting and provide insight in how the calculations have been performed.

The Netherlands seems to be a good choice to perform calculations based on our model. First, in The Netherlands, coalition governments are the standard, considering that the Dutch multi-party democracy only has had coalition governments since 1945 (Müller & Strøm, 2003). Also, The Netherlands has a tradition of majority coalitions. Furthermore, two of the issues we highlight - procedures and flexibility - are important. Concerning procedures, the process of coalition formation is by far the longest in Western Europe with an average of 70.6 days. This could denote an important role for procedures. The first mover issue is relevant as it is characteristic for the Dutch coalition practice that the biggest party gets the initiative to form a coalition. Concerning flexibility, coalition agreements play an important role in coalition negotiations: each cabinet agrees on such a document as the course of action during their period of government. Data however show different ideal policy positions of Dutch parties (e.g. De Vries, 1999; Van der Brug, 1999) which implies compromises and hence flexibility of parties.

The calculations have been done with an algorithm that has been developed and reported in Sáiz et al. (2007). In short, in the step-by-step case, the algorithm determines the coalition position and preferences of parties for all coalitions at each possible path. In this procedure, first the new positions and coalition positions for all the possible two-party coalitions are computed.

For each two-party coalition, the procedure builds up coalitions with $n > 2$ members adding new members one-by-one. If the maneuvering spaces of the new member i and the members of S overlap, the negotiation positions (for the new member and the coalition) are computed. If the new coalition $S \cup \{i\}$ is a winning coalition, then preferences for each member are calculated. In the simultaneous case, the number of possible coalitions is known given the number of parties, and the coalitions are generated. For each coalition, the procedure computes the coalition position and preferences. The computation of the negotiation positions uses an external nonlinear programming algorithm.

We provide an example here to illustrate how the algorithms work, what input they need, and what is their output. This example uses the Dutch election result of 2003. As input for the model, we need ideal policy positions of Dutch parties, and a weight and a radius for each political party. The ideal policy positions are derived from a data set with policy positions of Dutch political parties on 56 dimensions from 1998 and 2003 (Klingemann, Volkens, Bara, and & Budge, 2006). Because the model is working with spherical maneuvering spaces based on distance calculations, the data are all scaled between 0 and 10. The weight of the parties is determined by the amount of seats each party had in parliament (total of 150 seats). The radii that model the flexibility of the parties is relatively arbitrary for illustrative purposes and leave a degree of freedom for our analysis. In reality, each party has its own radius which is dependent on the specific situation and which might be subject to change. Due to the lack of empirical data on this aspect, we have taken two different ways to determine the radius: a radius similar for each party (in the 1998 and 2003 case) and a radius different for each party, randomly generated (for the 1998 case). In the cases in which we have used similar radii for all parties, the radii have been determined by optimizing the case such that enough, but not too many, instances were found which could help us investigate the hypotheses. For the 2003 case, Table 1 shows this input. The names of the parties are the following:

CDA - Christian Democrats (Christen Democratisch Appel)
CU - Christian Union (Christen Unie)

D66 - Democrats 66 (Democraten '66)
GRL - Green Left (Groen Links)
LPF - List Pim Fortuyn (Lijst Pim Fortuyn)
PvdA - Labor Party (Partij van de Arbeid)
SP - Socialist Party (Socialistische Partij)
VVD - People's Party for Freedom and Democracy (Volkspartij voor Vrijheid en Democratie)

Note that the SGP (Political Reformed Party) is not included in this table, as it was not included in the dataset from Klingemann et al. (2006) (in Appendix IV of Klingeman et al. (2006) is explained that the election program for the collection of data was missing).

Table 1: Example based on data for 2003

Party	Radius	Weight
CDA	30	44
CU	30	3
D66	30	6
GRL	30	8
LPF	30	8
PvdA	30	42
SP	30	9
VVD	30	28

As output of the model, we only consider coalition positions of majority coalitions of parties that have an overlap of their maneuvering spaces given their ideal policy positions, i.e. of feasible winning coalitions. As said earlier, the biggest party gets the initiative for coalition formation in The Netherlands. In 2003, this was the CDA. The majority coalitions with overlapping maneuvering spaces containing CDA are included in Table 2. For each coalition reached with a certain procedure, the distance between the coalition position and the ideal position of the party are calculated. The {PvdA, CDA} coalition leads to the same coalition position with both procedures as no third party joins here. However, for a coalition between CDA, PvdA, and LPF (e.g. {{CDA, PvdA}, LPF} and {CDA, PvdA, LPF}) procedure plays

a role as different procedures lead to different distances. More generally, we see in all the calculations done for this paper that procedure really makes a difference: different procedures lead to different results.

Table 2: Distances from ideal points for 2003 example

Step-by-Step Procedure									
Coalition	Seats	Distance							
		CU	D66	GRL	PvdA	SP	VVD	LPF	CDA
$\{CDA, PvdA\}$	86	-	-	-	20.52	-	-	-	20.07
$\{\{CDA, PvdA\}, SP\}$	95	-	-	-	24.92	29.39	-	-	26.92
{{CDA,PvdA},LPF}	94	-	-	-	25.45	-	-	29.24	23.69
$\{\{CDA, SP\}, PvdA\}$	95	-	-	-	26.04	29.42	-	-	25.97
{{CDA,LPF},PvdA}	94	-	-	-	25.38	-	-	29.15	23.86
Simultaneous Procedure									
		CU	D66	GRL	PvdA	SP	VVD	LPF	CDA
$\{CDA, PvdA\}$	86	-	-	-	20.52	-	-	-	20.07
$\{CDA, PvdA, SP\}$	95	-	-	-	26.01	29.00	-	-	26.47
{CDA,PvdA,LPF}	94	-	-	-	25.31	-	-	28.62	24.59

Based on these distances, the preferences of the players can be calculated. The closer the coalition position to the ideal position of a party, the more the party will prefer this coalition and the procedure. Table 3 reports this. As an example, CDA's most favorite option is to cooperate with PvdA. If CDA would cooperate with PvdA and SP, then the best procedure for CDA would be to negotiate first with SP alone. The step-by-step procedure with SP joining as last is CDA's least preferred procedure for this coalition. Note that we do not consider preferences of the parties not participating in the coalition.

Table 3: Preference order for 2003

Step-by-Step Procedure									
Coalition	Seats	Preference order							
		CU	D66	GRL	PvdA	SP	VVD	LPF	CDA
$\{CDA, PvdA\}$	86	-	-	-	1	-	-	-	**1**
$\{\{CDA, PvdA\}, SP\}$	95	-	-	-	2	2	-	-	**7**
$\{\{CDA, PvdA\}, LPF\}$	94	-	-	-	5	-	-	3	2
$\{\{CDA, SP\}, PvdA\}$	95	-	-	-	7	3	-	-	5
$\{\{CDA, LPF\}, PvdA\}$	94	-	-	-	4	-	-	2	3
Simultaneous Procedure									
		CU	D66	GRL	PvdA	SP	VVD	LPF	CDA
$\{CDA, PvdA\}$	86	-	-	-	1	-	-	-	1
$\{CDA, PvdA, SP\}$	95	-	-	-	6	1	-	-	6
$\{CDA, PvdA, LPF\}$	94	-	-	-	3	-	-	1	4

In reality, the coalition that formed was {CDA, VVD, D66}. Although it is not the aim of this paper to predict which coalitions have occurred, we can explain why this coalition did not appear in the results. According to the model and, in particular, the adopted input, this coalition would not be viable. That means that the adopted radii did not lead to an overlap of the parties' maneuvering spaces; the {CDA, VVD, D66} coalition is less acceptable than the coalitions that appear in the table.

4 Model implications: empirical cases and theoretical examples

To study the three hypotheses presented in Section 2, we provide empirical cases and theoretical examples. The empirical cases are based on generated data on which calculations are performed, as explained in Section 3. Also, we present theoretical examples. We aim to present these cases and examples as (counter-)instances which show whether the stated hypotheses hold. When analyzing those cases, one should note that three issues are important in determining a coalition agreement: weights of the players, distances between members' policy positions, and the amounts of flexibility parties have (the maneuvering spaces). In other words, to determine whether a result is really due to the phenomenon in the hypothesis, we should pay attention to these three issues.

4.1 Implications for procedure

The first hypothesis says that being a first-mover in coalition negotiations is advantageous. In the 2003 case presented above, we indeed saw that for the LPF being the first mover was advantageous. When comparing the LPF's preference on the two step-by-step procedures it is involved in, it prefers {{CDA, LPF}, PvdA} over {{CDA, PvdA}, LPF}. So, it prefers being a first mover over being a late mover. A small counter example can be found due to the PvdA that in the same coalition prefers to step in later. The data of 1998 show a stronger counter example, as can be observed from Tables 4 and 5.

Table 4: Weights and radius 45 for 1998 data

	Parties					
	GRL	SP	PvdA	D66	VVD	CDA
Radius	45	45	45	45	45	45
Seats	11	5	45	14	38	29

Table 5: Preference order for 1998 data

Step-by-Step Procedure							
Coalition	Seats	Preference order					
		GRL	SP	PvdA	D66	VVD	CDA
$\{\{PvdA, SP\}, CDA\}$	79	-	8	3	-	-	2
$\{\{PvdA, D66\}, CDA\}$	88	-	-	5	7	-	4
$\{\{PvdA, CDA\}, SP\}$	79	-	4	1	-	-	7
$\{\{PvdA, CDA\}, D66\}$	88	-	-	2	4	-	8
$\{\{\{PvdA, SP\}, D66\}, CDA\}$	93	-	5	10	9	-	6
$\{\{\{PvdA, SP\}, CDA\}, D66\}$	93	-	1	7	8	-	9
$\{\{\{PvdA, D66\}, SP\}, CDA\}$	93	-	9	11	5	-	6
$\{\{\{PvdA, D66\}, CDA\}, SP\}$	93	-	7	8	1	-	10
$\{\{\{PvdA, CDA\}, SP\}, D66\}$	93	-	2	6	8	-	9
$\{\{\{PvdA, CDA\}, D66\}, SP\}$	93	-	7	5	2	-	10
Simultaneous Procedure							
		GRL	SP	PvdA	D66	VVD	CDA
$\{PvdA, SP, CDA\}$	79	-	3	4	-	-	1
$\{PvdA, CDA, D66\}$	88	-	-	9	3	-	3
$\{PvdA, D66, SP, CDA\}$	93	-	6	12	6	-	5

In the 1998 case, PvdA was the biggest party and had to take the initiative in coalition negotiations. For the three party coalition {PvdA, SP, CDA}, two step-by-step and one simultaneous procedures were considered as PvdA always had to be a first mover. In the two step-by-step procedures, CDA would be better off being a late instead of a first mover. Let $\succ_i$ denote the preference relation of party i. For this coalition, the preference order of CDA is as follows: {PvdA, SP, CDA} $\succ_{CDA}$ {{PvdA, SP}, CDA} $\succ_{CDA}$ {{ PvdA, CDA}, SP}. This also holds for SP, which in case of step-by-step formation rather joins as last member in the negotiations. We can therefore conclude that hypothesis 1 does not hold:

R1: Being a first mover is not always advantageous.

4.2 Implications for flexibility

The second hypothesis states that being less flexible in coalition negotiations is more advantageous. A search in the data did not provide a counter example to this hypothesis. It was found that a decrease in a party's flexibility always seems to be in the party's advantage. In other words, the intuition which was provided earlier holds. As seen more easy in two-party coalitions, less flexibility always leads to a more advantageous coalition agreement for a party.

Although we did not find a counter-example in the Dutch data, we did come up with a one-dimensional theoretical example which shows that being less flexible can be a *disadvantage*.

Example 4.1 We consider a three-party example, in which parties 1 and 2 have the same weight, while the weight of party 3 is twice as big as the weight of party 1 and 2, i.e.

$$N = \{1, 2, 3\}, \quad w_1 = w_2, \quad w_3 = 2w_2$$

The situation is illustrated in Figure 4. Since this is a one-dimensional example, the ideal positions x_1^*, x_2^* and x_3^* are points (denoted in Figure 4 by squares) on a line, while the maneuvering spaces M_1, M_2 and M_3 are intervals (denoted in Figure 4 by two-headed arrows). We have

$$x_1^* = 0, \quad x_2^* = 4, \quad x_3^* = -2$$

All parties are assumed to be equally flexible and their radii are equal to

$$r_1 = r_2 = r_3 = 6$$

Hence, the maneuvering spaces are

$$M_1 = [-6, 6], \quad M_2 = [-2, 10], \quad M_3 = [-8, 4]$$

and their intersections (also two-headed arrows)

$$M_1 \cap M_3 = [-6, 4], \quad M_1 \cap M_2 = [-2, 6]$$

$$M_2 \cap M_3 = M_1 \cap M_2 \cap M_3 = [-2, 4] \neq \emptyset.$$

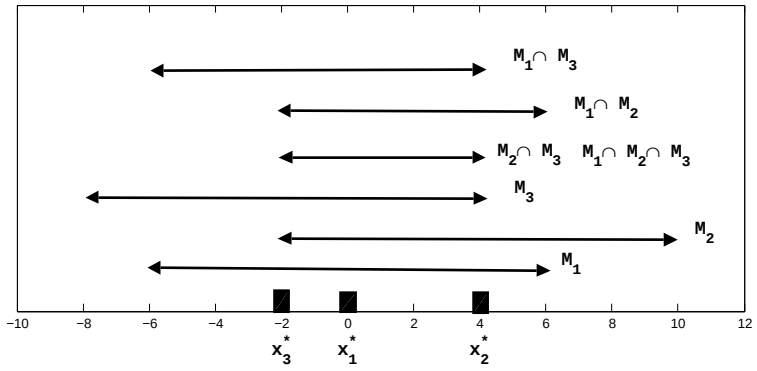

Figure 4: Counter-example "being less flexible can be a *disadvantage*". Ideal points (squares) and maneuvering spaces (two-headed arrows)

Since $M_1 \cap M_2 \cap M_3 \neq \emptyset$, the necessary condition for coalition $\{1,2,3\}$ to be formed is satisfied. Let us consider the step-by-step procedure of forming coalition $\{1,2,3\}$, in which first parties 1 and 2 form a coalition $\{1,2\}$, and then party 3 joins. The steps of the procedure are explained in Section 2.2. The negotiation positions $x_1^{\{1,2\}}$ and $x_2^{\{1,2\}}$ of parties 1 and 2 are equal to their ideal positions, because the ideal points lie in the intersection of the maneuvering spaces, i.e.

$$x_1^{\{1,2\}} = 0 = x_1^*, \quad x_2^{\{1,2\}} = 4 = x_2^*$$

Since the weights of parties 1 and 2 are the same and the coalition position is the gravity center of the negotiation positions, we get

$$x_{\{1,2\}} = 2 \in M_3$$

Next, party 3 joins proto-coalition $\{1,2\}$. Because x_3^* and $x_{\{1,2\}}$ lie in the intersection of the maneuvering spaces, the negotiation positions of party 3 and proto-coalition $\{1,2\}$ are equal to $x_3^* = -2$ and $x_{\{1,2\}} = 2$, respectively. Since the weight of party 3 is equal to the weight of $\{1,2\}$, we get

$$x_{\{\{1,2\},3\}} = 0 = x_1^*$$

Hence, the step-by-step procedure of forming $\{\{1,2\},3\}$, in which first parties 1 and 2 form a coalition, and then party 3 joins, leads to the coalition position $x_{\{\{1,2\},3\}}$ which is the best possible position for party 1.

Next, let us assume that party 1 becomes less flexible, that is, its new radius decreases to $r_1' = 3$. All remaining components of the example are unchanged. Then,

$$M_1' = [-3, 3], \quad M_1' \cap M_2 = M_1' \cap M_2 \cap M_3 = [-2, 3]$$

We consider the same step-by-step procedure of forming $\{1, 2, 3\}$ with the new radius $r_1' = 3$. The new negotiation position $y_1^{\{1,2\}}$ of party 1 is the same as before (equals $x_1^{\{1,2\}}$), since its ideal point lies in the intersection of the maneuvering spaces. However, the new negotiation position $y_2^{\{1,2\}}$ of party 2 is different, i.e.

$$y_1^{\{1,2\}} = x_1^* = 0, \quad y_2^{\{1,2\}} = 3.$$

The new position $y_{\{1,2\}}$, as the gravity center of $y_1^{\{1,2\}}$ and $y_2^{\{1,2\}}$ with equal weights $w_1 = w_2$, is now

$$y_{\{1,2\}} = \frac{3}{2} \in M_3$$

The new coalition position $y_{\{\{1,2\},3\}}$, as the gravity center of the negotiation positions $y_{\{1,2\}}$ and $x_3^* = -2$, with equal weights for $\{1, 2\}$ and party 3, is now

$$y_{\{\{1,2\},3\}} = -\frac{1}{4}$$

Hence, the step-by-step procedure of forming $\{\{1, 2\}, 3\}$, in which first parties 1 and 2 form a coalition, and then party 3 joins, results now in the coalition position $y_{\{\{1,2\},3\}}$ which is worse for party 1 than the coalition position $x_{\{\{1,2\},3\}}$, for the case where party 1 is more flexible, i.e.

$$x_{\{\{1,2\},3\}} \succ_1 y_{\{\{1,2\},3\}}$$

This means that becoming less flexible made party 1 worse off.

To conclude, although the data have shown that less flexibility always seems to be advantageous to a party, a theoretical counter example has illustrated how a decrease in flexibility can be a disadvantage for a party. Hence:

R2: When forming a k-party coalition, for $k \geq 3$, being less flexible is usually advantageous, but can theoretically be a disadvantage.

4.3 Implications for power sharing

Hypothesis 3a argues that being in a minimal winning coalition is more advantageous than being in an oversized coalition. We have found many counter-examples in Dutch data which show that the hypothesis does not always hold. We consider Dutch data after the 1998 elections (see Table 4). Here, we change the radii for the parties and let the radius be different for different parties. We get an instance as shown in Table 6. Table 7 shows the preference order for this case. Note that under the step by step as well as simultaneous procedure, PvdA finds the non-minimal winning coalition formed by PvdA, VVD and D66 more attractive than the minimal winning coalition {PvdA, VVD}.

Table 6: Weights and different radii for 1998

	Parities					
	GRL	SP	PvdA	D66	VVD	CDA
Radius	45	55	25	65	85	45
Seats	11	5	45	14	38	29

Concluding, we get the following result.

R3a: *Forming a minimal winning coalition is not always advantageous.*

The last hypothesis (3b) says that an increase of a party's weight is disadvantageous for its coalition partners. One can show that forming a two-party coalition with a stronger party is never advantageous to the coalition partner. The intuition is that in such a 'zero-sum' situation, the larger party will always be able to pull the coalition position to its own position, further away from its partner. Nevertheless, it does not necessarily hold when forming a larger coalition. We can illustrate this with the following theoretical example.

Example 4.2 We consider the same situation as in Example 4.1 with party 1 being less flexible, i.e.,

$$N = \{1, 2, 3\}, \quad x_1^* = 0, \quad x_2^* = 4, \quad x_3^* = -2$$

Table 7: Preference order with different radii for 1998

Step-by-Step Procedure							
Coalition	Number of seats	Preference order					
		GRL	SP	PvdA	D66	VVD	CDA
$\{PvdA, VVD\}$	83	-	-	**3**	-	1	-
$\{\{PvdA, SP\}, VVD\}$	88	-	4	12	-	5	-
$\{\{PvdA, D66\}, VVD\}$	97	-	10	**1**	11	6	-
$\{\{PvdA, VVD\}, SP\}$	88	-	8	7	-	4	-
$\{\{PvdA, VVD\}, D66\}$	97	-	11	**2**	10	2	-
$\{\{\{PvdA, SP\}, D66\}, VVD\}$	102	-	1	8	1	12	-
$\{\{\{PvdA, SP\}, VVD\}, D66\}$	102	-	2	11	2	10	-
$\{\{\{PvdA, D66\}, SP\}, VVD\}$	102	-	6	5	5	12	-
$\{\{\{PvdA, D66\}, VVD\}, SP\}$	102	-	9	4	7	11	-
$\{\{\{PvdA, VVD\}, SP\}, D66\}$	102	-	5	7	4	9	-
$\{\{\{PvdA, VVD\}, D66\}, SP\}$	102	-	9	6	6	7	-
Simultaneous Procedure							
		GRL	SP	PvdA	D66	VVD	CDA
$\{PvdA, VVD\}$	83	-	-	**3**	-	1	-
$\{PvdA, SP, VVD\}$	88	-	7	10	-	3	-
$\{PvdA, D66, VVD\}$	97	-	11	**2**	8	2	-
$\{PvdA, SP, D66, VVD\}$	102	-	3	9	3	8	-

$$r_1' = 3, \quad r_2 = r_3 = 6, \quad w_1 = w_2, \quad w_3 = 2w_2$$

$$M_1' = [-3, 3], \quad M_2 = [-2, 10], \quad M_3 = [-8, 4]$$

$$M_1' \cap M_2 = M_1' \cap M_2 \cap M_3 = [-2, 3]$$

As calculated in Example 4.1, the coalition position $y_{\{\{1,2\},3\}}$ results from the step-by-step procedure of forming $\{\{1, 2\}, 3\}$, in which first parties 1 and 2 form a coalition, and then party 3 joins, is equal to $y_{\{\{1,2\},3\}} = -\frac{1}{4}$. Next, let us assume that the weight of party 1 increases: it is twice as big as the weight of party 2 and the same as the weight of party 3, i.e.,

$$w_1' = 2w_2 = w_3$$

The remaining components of the model remain unchanged. We consider the same step-by-step procedure of forming $\{\{1, 2\}, 3\}$. The new negotiation positions $z_1^{\{1,2\}}$, $z_2^{\{1,2\}}$, and coalition positions $z_{\{1,2\}}$, $z_{\{\{1,2\},3\}}$ are now the following:

$$z_1^{\{1,2\}} = x_1^* = 0, \quad z_2^{\{1,2\}} = 3, \quad z_{\{1,2\}} = 1 \in M_3$$

$$z_{\{\{1,2\},3\}} = -\frac{1}{5}$$

Comparing the distance between coalition position $y_{\{\{1,2\},3\}}$ and the ideal point x_2^* of party 2 and the distance between the new coalition position $z_{\{\{1,2\},3\}}$ and x_2^*, one can conclude that

$$z_{\{\{1,2\},3\}} \succ_2 y_{\{\{1,2\},3\}}$$

It means that an increase of the weight of party 1 makes party 2 better off.

This gives the following result.

R3b: *When forming a k-party coalition, for $k \geq 3$, an increase of a party's weight may be an advantage for its coalition partner.*

In order to show a pure effect of an increase of a party's weight in Example 4.2, somewhat artificially we have increased the weight of party 1, keeping all remaining elements unchanged. This is of course not what happens in a parliament, since elections (usually) preceding coalition formation fix the weights of the parties. However, it can be used by parties defining a coalition formation strategy before elections. For example, in its campaign a party may be less negative with respect to another party whose bigger size might be beneficial. Nevertheless, although we believe that this result is mainly of a theoretical nature, we have also constructed an instance using the data. Consider the case of Table 6 that presents the 1998 data with varying flexibility for the parties taking the real number of seats. The distance of the ideal of D66 to the compromise of coalition $\{\{\{PvdA, SP\}, D66\}, VVD\}$ is 52.25. Let us now hypothetically assume that SP increases its weight by 30, while the other parties keep their original weights. Now the distance of the ideal of D66 to the coalition position becomes 51.53. This means its position improves due to an increase of another party.

5 Conclusions

In spite of the many unwritten laws and traditions during coalition formation in countries as Italy, Luxembourg, The Netherlands, Belgium, and Ireland, political parties should be aware of the important role of the process of coalition formation. In this paper, we have shown how several aspects of this

coalition process play an important role for the result of the coalition negotiations. We describe a formal model of coalition formation which considers political parties as players with ideal policy positions and maneuvering spaces denoting their flexibility to deviate from their ideal points. The output of the model is a set of feasible coalitions, which have a majority and whose members' maneuvering spaces overlap. The model describes which coalition position will be reached by the members given the procedure adopted.

We have focussed on three aspects of coalition formation: procedure, flexibility, and power sharing. The following questions which political parties may (and should) take into account when forming a coalition were under study: Does procedure of coalition negotiations matter? Is it more advantageous to be a first-mover in the coalition process? Is it better to be more or less flexible in coalition formation? Should we invite more parties to join to a (minimal) winning coalition or is it better to stay with the existing one(s)? Is it better to form a coalition with a stronger party or rather with a smaller one? Via empirical analysis with Dutch data and theoretical results, we have arrived at several (counter-)examples. These counter-examples have shown the importance of the process and give important implications for political parties involved in coalition formation. Also, these results have implications for future coalition research. We discuss both kinds of implications in this concluding section.

First, procedure matters. When forming a coalition, political parties should be aware of the important role procedure plays in determining the result of the coalition. Our model has shown that procedure partly determines which coalition point is agreed on. However, earlier research has analyzed that there is not one procedure which is always best (De Ridder & Rusinowska, 2008). This result contrasts the general practice of coalition formation in which procedures are generally formalized in pre-determined laws or traditions. Political parties can nevertheless benefit by manipulating the procedure. Also, for coalition models, especially dynamic models, the procedure should be taken into account (c.f. Grofman, 1982).

Related to procedure is the second conclusion that being a first mover is not necessarily advantageous. This result is also surprising in the sense that in many countries (e.g. The Netherlands, Belgium, Luxembourg, and

Austria) the tradition is that the largest party can start the negotiations and determines who will negotiate first. Being involved early in the process is considered an advantage. However, from the model it appeared that this is not always the case. The rationale here is that, by studying coalition compromises the other coalition partners will reach without a party (assuming complete information), this party can estimate whether this compromise is close to its ideal position. If it is, it may pay to join later. If the compromise is not close, it may be better for the party to join earlier in the process.

The third conclusion is that being less flexible is not necessarily advantageous. In the data, we have found that being less flexible results in a (pre-)coalition compromise which is closer to a party's position. So, being less flexible pays off. Nevertheless, we have presented a theoretical three-party counter-example in which being less flexible is a disadvantage. In this example, the first mover's ideal position was somewhere between the ideal position of the remaining two parties. Although being less flexible gave a better pre-coalition outcome, the final coalition position was worse for the party than the coalition position with the party being more flexible.

The final conclusions contradict the ideas of power sharing theories (as minimal winning theory). It appeared that forming a minimal winning coalition is not necessarily advantageous. Moreover, forming a coalition with a stronger party is not necessarily disadvantageous. So, it might pay off to share power with more and stronger parties than predicted by power sharing theory. To explain this counter-intuitive finding, for the minimal winning case it holds that new parties may determine a final coalition outcome closer to a party's ideal position, although this depends on the ideal positions of the new parties. For the stronger partner case, a stronger party joining usually moves the pre-coalition compromise further from a party's own ideal position. However, a strong party may determine a final coalition position which is closer to a party's position. In that case, a strong partner may be beneficial to cooperate with.

In sum, these four conclusions lead to the main message of the article. With the paper, we have shown that the principles underlying coalition practice and the assumptions and intuition around coalition theory do not necessarily hold. Coalition dynamics, here, that is coalition procedure, being

a first-mover, and policy flexibility, play a more important role than has so far been generally acknowledged in the coalition literature (with exceptions such as Brams, Jones & Kilgour, 2005, Warwick, 2005a, 2005b). We have provided theoretical examples and empirical cases which confirm the thesis that the coalition process matters. We aim to reach the agenda of coalition research with this message. Due to the focus on making and illustrating this message, we have neglected other aspects of the research. We suggest for future research to investigate how to empirically determine a party's flexibility, development of more dynamic coalition models, and empirical analyses of more countries.

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